WE CLAIM:

1. A method for identifying a compound capable of interfering with binding of an MRE11 polypeptide or fragment thereof, the method comprising the steps of:

(i) combining an MRE11 polypeptide or fragment thereof with a polypeptide selected from the group consisting of RAD50 and NBS1, and the compound, wherein the MRE11 polypeptide or fragment thereof has nuclease activity and is encoded by a nucleic acid that hybridizes under stringent conditions to a nucleic acid encoding a polypeptide having an amino acid sequence of SEQ ID NO:2; and

(ii) determining the binding of the MRE11 polypeptide or fragment thereof to a polypeptide selected from the group consisting of RAD50 and NBS1.

2. The method of claim 1, wherein the MRE11 polypeptide or fragment thereof and the RAD50 or NSB1 polypeptide are combined first.

3. The method of claim 1, wherein the MRE11 polypeptide or fragment thereof and the RAD50 and NSB1 polypeptide are combined.

4. The method of claim 1, wherein the MRE11 polypeptide or fragment thereof and the RAD50 or NSB1 polypeptide are expressed in a cell.

5. The method of claim 4, wherein the cell is a yeast cell or a mammalian cell.

6. The method of claim 5, wherein the MRE11 polypeptide or fragment thereof is fused to a heterologous polypeptide.

7. The method of claim 1, wherein the binding of the MRE11 polypeptide or fragment thereof to RAD50 or NSB1 is determined by measuring reporter gene expression.

8. A method for identifying a compound that modulates cellular proliferation or chemosensitivity, the method comprising the steps of:

(i) contacting the compound with an MRE11 polypeptide, the polypeptide encoded by a nucleic acid that hybridizes under stringent conditions to a nucleic acid encoding a polypeptide having an amino acid sequence of SEQ ID NO:2; and

(ii) determining the functional effect of the compound upon the MRE11 polypeptide.

9. The method of claim 8, wherein the functional effect is measured *in vitro*.

10. The method of claim 9, wherein the functional effect is a physical effect.

11. The method of claim 10, wherein the physical effect is determined by measuring substrate binding to the polypeptide.

12. The method of claim 9, wherein the functional effect is a chemical effect.

13. The method of claim 12, wherein the chemical effect is determined by measuring endonuclease or exonuclease activity of the MRE11 polypeptide.

14. The method of claim 8, wherein the polypeptide is expressed in a eukaryotic host cell.

15. The method of claim 14, wherein the functional effect is a physical effect.

16. The method of claim 15, wherein the physical effect is determined by measuring ligand binding to the polypeptide.

17. The method of claim 14, wherein the functional effect is a chemical or phenotypic effect.

18. The method of claim 17, wherein the chemical or phenotypic effect is determined by measuring endonuclease or exonuclease activity of the MRE11 polypeptide.

19. The method of claim 17, wherein the chemical or phenotypic effect is determined by measuring cellular proliferation.

20. The method of claim 19, wherein the cellular proliferation is measured by assaying for DNA synthesis or fluorescent marker dilution.

21. The method of claim 20, wherein DNA synthesis is measured by ^{3}H thymidine incorporation, BrdU incorporation, or Hoescht staining.

22. The method of claim 20, wherein the fluorescent marker is selected from the group consisting of a cell tracker dye or green fluorescent protein.

23. The method of claim 8, wherein modulation is inhibition of cellular proliferation.

24. The method of claim 8, wherein modulation is inhibition of cancer cell proliferation.

25. The method of claim 8, wherein modulation is activating sensitivity to chemotherapeutic reagents.

26. The method of claim 8, wherein modulation is activating sensitivity of cancer cells to chemotherapeutic reagents.

27. The method of claim 14, wherein the host cell is a cancer cell.

28. The method of claim 27, wherein the cancer cell is a breast, prostate, colon, or lung cancer cell.

29. The method of claim 27, wherein the cancer cell is a transformed cell line.

30. The method of claim 29, wherein the transformed cell line is PC3, HI299, MDA-MB-231, MCF7, A549, or HeLa.

31. The method of claim 27, wherein the cancer cell is p53 null or mutant.

32. The method of claim 27, wherein the cancer cell is p53 wild-type.

33. The method of claim 27, wherein the cancer cell is treated with bleomycin or etoposide.

34. The method of claim 8, wherein the polypeptide is recombinant.

35. The method of claim 8, wherein the polypeptide is encoded by a nucleic acid having a sequence of SEQ ID NO:1.

36. The method of claim 8, wherein the compound is an antibody.

37. The method of claim 8, wherein the compound is an antisense molecule.

38. The method of claim 8, wherein the compound is a small organic molecule.

39. The method of claim 8, wherein the compound is a peptide.

40. The method of claim 39, wherein the peptide is circular.

41. A method for identifying a compound that modulates cellular proliferation or chemosensitivity, the method comprising the steps of:

(i) contacting the compound with an MRE11 polypeptide or a fragment thereof, the MRE11 polypeptide or fragment thereof encoded by a nucleic acid that hybridizes under stringent conditions to a nucleic acid encoded by a polypeptide comprising an amino acid sequence of SEQ ID NO:2;

(ii) determining the physical effect of the compound upon the SAK polypeptide; and

(iii) determining the chemical or phenotypic effect of the compound upon a cell comprising an MRE11 polypeptide or fragment thereof, thereby identifying a compound that modulates cellular proliferation or chemosensitivity.

42. A method of modulating cellular proliferation in a subject, the method comprising the step of administering to the subject a therapeutically effective amount of a compound identified using the method of claim 8.

43. The method of claim 42, wherein the subject is a human.

44. The method of claim 43, wherein the subject has cancer.

45. The method of claim 42, wherein the compound is an antibody.

46. The method of claim 42, wherein the compound is an antisense molecule.

47. The method of claim 42, wherein the compound is a small organic molecule.

48. The method of claim 42, wherein the compound is a peptide.

49. The method of claim 48, wherein the peptide is circular.

50. The method of claim 42, wherein the compound inhibits cancer cell proliferation.

51. A method of modulating cellular proliferation in a subject, the method comprising the step of administering to the subject a therapeutically effective amount of a MRE11 polypeptide, the polypeptide encoded by a nucleic acid that hybridizes under stringent conditions to a nucleic acid encoding a polypeptide having an amino acid sequence of SEQ ID NO:2.

52. A method of modulating cellular proliferation in a subject, the method comprising the step of administering to the subject a therapeutically effective amount of a nucleic acid encoding a MRE11 polypeptide, wherein the nucleic acid hybridizes under stringent conditions to a nucleic acid encoding a polypeptide having an amino acid sequence of SEQ ID NO:2.